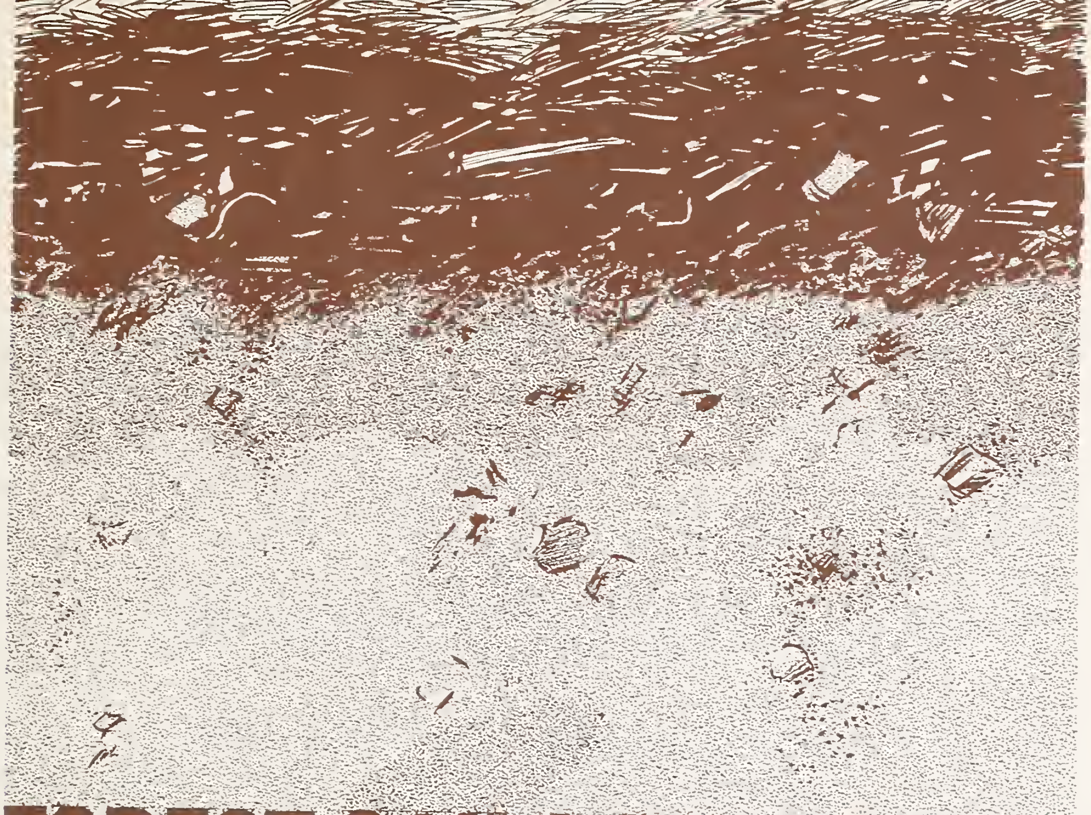

FOREST SOILS RESEARCH in Oregon and Washington

A bibliography with abstracts through 1963

compiled by
Robert F. Tarrant

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U.S. DEPT. OF AGRICULTURE · FOREST SERVICE

U.S. FOREST SERVICE
RESEARCH PAPER PNW 15
1964

U.S. FOREST SERVICE
Research Paper PNW-15

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October 1964

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
Philip A. Briegleb, Director Portland, Oregon

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

FOREWORD

The purpose of this paper is to reference and briefly summarize all published forest soils research done in Oregon and Washington--from observations by Hanzlik in 1914 to those made by a later generation of scientists through 1963.

Most forest soils research in the Pacific Northwest started after World War II when activity in this research field was accelerated. Of 139 references listed, only 11 were published before 1947. Thus, we have a unique opportunity in this subject matter area to summarize current status of published knowledge for handy reference.

Excellent publications on results of forest soils research are also available from regions adjacent to Oregon and Washington. Deciding where to draw a boundary as a basis for inclusion of references was difficult, however, especially when applicability of results was considered. We decided, therefore, to limit this summary to research done within the boundaries of only two States. Perhaps workers in other regions will find it profitable also to develop summaries of forest soils research for their areas.

We have attempted in the abstracts to accurately brief major findings or theme of each reference. This condensed information is intended only to lead the reader to the original publication for any study in which he may be especially interested.[1/] A subject matter index is also provided for the reader's convenience.

The author was assisted in this compilation by members of the Northwest Forest Soils Council. We will appreciate being notified of any omissions.

1/ Publications listed herein are not available from the Pacific Northwest Forest and Range Experiment Station unless issued by that organization. Requests for reprints should be addressed to the author cited.

BIBLIOGRAPHY

1. Anonymous.
1914. A study of the growth and yield of Douglas fir on various soil qualities in western Washington and Oregon, by E. J. Hanzlik. [A review.] Forestry Quart. 12: 440-441.

Douglas-fir grows best on slopes rather than on level land, and good drainage is necessary. Best soils for Douglas-fir are medium to deep loams with sandy or gravelly subsoils; shallow loams or shallow sands with rock outcrops are poor. Douglas-fir often grows better on benchlands and hill soils than on bottom lands.

2. Anonymous.
1952. Forest soils not depleted by timber harvest. Jour. Forestry 50: 872.

Mineral elements removed from soil by trees are largely returned to the soil as leaf litter which soil organisms decompose into its original constituents for reuse. Because of the long time required to produce a tree crop, soil nutrient depletion is more than counterbalanced by weathering of soil minerals, addition of nitrogen by rainfall, and action of nitrogen-fixing soil organisms.

3. Anonymous.
1956. Minimizing watershed disturbance from logging operations. Soc. Amer. Foresters Proc. 1955: 202-205.

Eleven questions, most of which concerned soil disturbance after logging, were directed to a panel of foresters. Answers are given in detail.

4. Anderson, Henry W.
1954. Suspended sediment discharge as related to streamflow, topography, soil, and land use. Amer. Geophys. Union Trans. 35: 268-281, illus.

Includes (1) map of sediment-producing potential of lands in western Oregon under average land use; (2) estimate of how actual production of sediment would differ from the potential with deviation of land use from average; and (3) data on sediment production from forest land, agricultural land, and main river channel banks.

5. Arnold, John F.
1963. The delineation of field stability hazards. In Forest Watershed Management Symposium. Oreg. State Univ., pp. 193-214, illus.

Discusses principles involved in initial stratification of landscape features for extending experience with soil stability. Describes some factors involved in appraising forest soil stability.

6. Arnold, John F.
1963. Road location to retain maximum stability. In Forest Watershed Management Symposium. Oreg. State Univ., pp. 215-224, illus.

Discusses some basic principles in locating forest roads to prevent undue erosion of forest land.

7. Austin, R. C., and Baisinger, D. H.
1950. Manual for forest soils evaluation. Crown Zellerbach Corp., 24 pp., illus.

A compilation of information, in pocket form for field use, for typing forest soils to determine land value in terms of wood productivity.

8. __________ and Baisinger, D. H.
1955. Some effects of burning on forest soils of western Oregon and Washington. Jour. Forestry 53: 275-280, illus.

Measurable physical and chemical effects of fire were confined to the top 2 inches of soil. Two years after burning, organic matter, nitrogen, and available mineral elements had increased substantially over levels immediately after the fire. Three cases are described in which poor seedling growth was ascribed to soil deterioration after fire.

9. __________ and Strand, R. F.
1960. The use of slowly soluble fertilizers in forest planting in the Pacific Northwest. Jour. Forestry 58: 619-627, illus.

Reports results of fertilizer trials with commercial resin, DuPont Uramite, pelleted with superphosphate on plantations of Douglas-fir, grand fir, noble fir, Monterey pine, and a hybrid pine *(Pinus attenuata X radiata)* at four locations in Oregon and Washington. Height and diameter growth response varied with species and location. Possible interactions of site preparation, climate, species sensitivity to fertilizer, and time after fertilizing are discussed.

10. Banta, David.
1963. Maintaining soil stability in the design and construction of logging roads. In Forest Watershed Management Symposium. Oreg. State Univ., pp. 225-231.

Logging road design should include consideration of soil characteristics. Engineers and construction supervisors should correlate personal experience with knowledge of soil characteristics to more effectively maintain soil stability in areas affected by roadbuilding.

11. Bethlahmy, Nedavia.
1958. Forests and water yield. Amer. Soc. Civ. Engin. Proc. 84 (SA6, 1848): 1-5.

Forest environment can be manipulated to manage water resources, but soil impairment must be avoided.

12. __________
1960. Fertilizer helps establish grass seedings on abandoned logging roads. Jour. Forestry 58: 965-966, illus.

Heavy applications of fertilizer increase chances of establishing grass seedings on abandoned logging roads in the western part of the Cascade Range.

13. __________
1960. Surface runoff and erosion--related problems of timber harvesting. Jour. Soil & Water Conserv. 15(4): 158-161, illus.

A discussion of the effects of roads, logging methods, and controlled burning on surface runoff and erosion, and the role of research in solving these problems.

14. __________
1962. First year effects of timber removal on soil moisture. Internatl. Assoc. Sci. Hydrol. Bul. 7(2): 34-38, illus.

A study of undisturbed soils of clear cuts and adjacent nonlogged virgin forests in western Oregon indicated that clear cutting reduces soil moisture depletion and accelerates recharge.

15. __________
1963. Soil-moisture sampling variation as affected by vegetation and depth of sampling. Soil Sci. 95: 211-213.

Soil moisture variation is less under forest cover than in clear-cut areas and decreases in proportion to depth in the soil profile.

16. Bishop, Daniel M.
1961. Soil moisture depletion in three lodgepole pine stands in northeastern Oregon. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 213, 2 pp., illus.

Substantial amounts of soil moisture are consumed during the growing season in lodgepole pine stands of the Blue Mountains. Combined effects of evaporation and transpiration appear to account for a major part of the moisture depletion.

17. __________
1962. Lodgepole pine rooting habits in the Blue Mountains of northeastern Oregon. Ecology 43: 140-142, illus.

Lodgepole pine trees growing in basalt-pumice soils of the Blue Mountains develop distinct lateral and vertical root systems. Most roots

are in the highly permeable pumicite layer. Dense growth of rootlets on the lower taproot may be caused by nutrients and moisture stored in the residual basalt soil beneath pumicite.

18. Bollen, W. B., and Wright, Ernest.
    1961. Microbes and nitrates in soils from virgin and young-growth forests. Canad. Jour. Microbiol. 7: 785-792.

    Discusses distribution of *Penicillium*, *Mucor*, and *Aspergillus* spp. in forest soils and compares nitrate-nitrogen content in soil beneath several major forest tree species.

19. Carmean, Willard H.
    1954. Site quality for Douglas-fir in southwestern Washington and its relationship to precipitation, elevation, and physical soil properties. Soil Sci. Soc. Amer. Proc. 18: 330-334, illus.

    Douglas-fir site quality in southwestern Washington appears to be correlated with available soil moisture during the growing season. Site quality increased as soil depth and precipitation increased and decreased as gravel content, soil compaction, and elevation increased. The product of moisture equivalent times percent gravel was directly correlated with site quality.

20. ____________
    1956. Suggested modifications of the standard Douglas-fir site curves for certain soils in southwestern Washington. Forest Sci. 2: 242-250, illus.

    Site curves for stands on soils derived from basalts, sandstones, and shales are similar to standard Douglas-fir site curves used in the Pacific Northwest. However, trees growing on gravels and sands and on soils with imperfect internal drainage have markedly different site curves. When stands are less than 100 years of age, the standard curves overestimate site quality on sands and gravels and underestimate site quality on imperfectly drained soils.

    Modified site curves are presented for Douglas-fir established on gravels and on soils with imperfect internal drainage.

21. Cole, D. W., Gessel, S. P., and Held, E. E.
    1961. Tension lysimeter studies of ion and moisture movement in glacial till and coral atoll soils. Soil Sci. Soc. Amer. Proc. 25: 321-325, illus.

    Effectiveness of an alundum tension lysimeter was studied in two widely contrasting soils--one developed on glacial till in western Washington and another from a coral atoll of the northern Marshall Islands. The lysimeter is shown to be useful for measuring ion content of gravitational soil water. Amount of nutrient ion leaching is described for both soils.

22. Deardorff, C. E., and Lloyd, William J.
1958. Interpreting soil surveys for use in growing wood crops. First No. Amer. Forest Soils Conf. Proc. 1958: 213-217.

Three key soils with distinctly different suitabilities for wood crops are described in detail, and interpretations and conservation practice recommendations are made for each soil. The soil survey, with proper interpretation, is considered a logical and scientific base for managing forests in accordance with capabilities and limitations of the land.

23. Dimock, Edward J., II.
1958. Litter fall in a young stand of Douglas-fir. Northwest Sci. 32: 19-29, illus.

Over a 6-year period, litter fall decreased with increased intensity of thinning. Litter fall varies between years and between seasons within 1 year. Extreme low temperatures may triple amount of litter that falls the ensuing year.

24. Dunford, E. G.
1956. A watershed research program for the Pacific Northwest. Soc. Amer. Foresters Proc. 1955: 190-195.

Soils aspects of a proposed watershed research program include studies designed to help control disturbance and movement of forest soils in logging and other management operations. A major line of investigation is to determine physical characteristics and management requirements of important soil types in forest and range watersheds of the Pacific Northwest.

25. ________
1958. Forest soils--enigma of Northwest watersheds. First No. Amer. Forest Soils Conf. Proc. 1958: 20-24.

Discusses general characteristics of soil; geology and climate of the Pacific Northwest; land uses affecting soils; effects of roadbuilding, logging, and fire on watershed soils; and future trends in research.

26. ________
1958. Watershed management research in the Pacific Northwest. Jour. Soil & Water Conserv. 13(1): 23-26.

A summary of problems and description of an active research program including studies of soil erosion and stability in relation to logging and roadbuilding, erosion hazard, and rehabilitation of eroded lands.

27. ________
1960. Watershed management research in the Lake States, Intermountain, and Pacific Northwest Regions. Jour. Forestry 58: 288-290.

A summary of soil and water investigations by research organizations on forest and range lands.

28. Dunford, Earl G.
1962. Logging methods in relation to streamflow and erosion. Fifth World Forestry Cong. Proc. 3: 1703-1708.

Reviews status of knowledge about influence of logging and road-building on forest soil erosion. Lists recommendations for minimizing erosion and stream damage during and following logging operations.

29. Dyrness, C. T.
1963. Effects of burning on soil. In Forest Watershed Management Symposium. Oreg. State Univ., pp. 291-304.

Summarizes available information with particular reference to studies of slash burning in the Douglas-fir region.

30. ___________ and Youngberg, C. T.
1957. The effect of logging and slash-burning on soil structure. Soil Sci. Soc. Amer. Proc. 21: 444-447, illus.

Soil structure was damaged only where soil was severely burned, but only 8 percent of the soil surface was in this category. Thus, high-lead logging and burning slash in the fall after a rain had no appreciable detrimental effect on soil structure over the area as a whole.

31. ___________ and Youngberg, C. T.
1958. Soil-vegetation relationships in the central Oregon pumice region. First No. Amer. Forest Soils Conf. Proc. 1958: 57-66.

Describes soil-vegetation relationships under lodgepole and ponderosa pine and under ponderosa pine associated with bitterbrush, manzanita, snowbrush, and Idaho fescue. Discusses profile variability in the Lapine soil series, explains features of well-drained and poorly drained soils, and suggests application of soil-vegetation information to forest management practices.

32. ___________ Youngberg, C. T., and Ruth, Robert H.
1957. Some effects of logging and slash burning on physical soil properties in the Corvallis watershed. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Paper 19, 15 pp., illus.

Soil structure was damaged only where soil was severely burned, but only 8 percent of the soil surface was in this category. Thus, high-lead logging and burning slash in the fall after a rain had no appreciable detrimental effect on soil structure over the area as a whole.

33. Enberg, Paul.
1963. Design of roadway drainage to prevent erosion on forested watersheds. In Forest Watershed Management Symposium. Oreg. State Univ., pp. 233-251, illus.

Factors influencing road drainage design and steps in designing road drainage systems are described.

34. Erickson, Harvey D., and Lambert, Gregory M. G.
1958. Effects of fertilization and thinning on chemical composition, growth, and specific gravity of young Douglas-fir. Forest Sci. 4: 307-315.

Little difference in wood quality was noted between trees from various fertilizer and thinning treatments. Growth rate, in descending order by treatment, was: fertilized and thinned, fertilized, thinned, and untreated. Percent of summerwood decreased significantly after thinning and fertilizing. The increased volume increment obtained by fertilizing and thinning had much more fiber than wood of the same age in untreated stands.

35. Flannery, Robert D.
1940. Physical character and chemical composition of forest floors under selected forest types in western Washington. [Abs.] Ecol. Soc. Amer. Bul. 21: 11.

Litter of forest trees maintains a high base content in the forest floor, which perhaps explains why podsolization proceeds very slowly in northwestern Washington.

36. Forest Soils Committee of the Douglas-fir Region.
1953. Sampling procedures and methods of analysis for forest soils. 38 pp., illus. Seattle: Univ. Wash.

Methods of sampling and detailed procedures for physical and chemical analysis of forest soils are given in an attempt to standardize results.

37. ______
1957. An introduction to the forest soils of the Douglas-fir region of the Pacific Northwest. Various paging, illus. Seattle: Univ. Wash.

Provides some essential regional forest soils information, points out some common soils problems and soil-plant interrelationships, and explains fundamentals of forest soils in terms of those found in the Douglas-fir region.

38. Forristall, Floyd F., and Gessel, S. P.
1955. Soil properties related to forest cover type and productivity on the Lee Forest, Snohomish County, Washington. Soil Sci. Soc. Amer. Proc. 19: 384-389, illus.

Depth to hardpan layer was important for rating soil productivity for tree growth. Poor soil drainage appeared to be the dominating influence on forest type.

39. Fowells, H. A., and Stephenson, R. E.
1934. The effect of burning on forest soils. Soil Sci. 38: 175-181.

Temporarily stimulating nitrification and increasing soluble mineral nutrients in the soil by burning may be helpful in some respects. However, forest soil productivity depends upon gradual mineralization of fallen litter, so continuous and often repeated burning cannot be expected to improve fertility.

40. Fredriksen, R. L.
1963. A case history of a mud and rock slide on an experimental watershed. Pac. NW. Forest & Range Expt. Sta. U.S. Forest Serv. Res. Note PNW-1, 4 pp., illus.

Description of a landslide typical of many which occur during winter storms in steep forest lands of the Pacific Northwest.

41. Garrison, George A., and Rummell, Robert S.
1951. First-year effects of logging on ponderosa pine forest range lands of Oregon and Washington. Jour. Forestry 49: 708-713, illus.

Tractor logging removed more herbaceous and shrubby vegetation and covered more of the logged area with slash than did cable logging. Horse logging was least damaging to vegetation. Soil was deeply disturbed on 15 percent of the tractor-logged area. In contrast, only 2 percent of cable- and horse-logged areas was thus affected. Reductions in quantity and quality of grasses damaged grazing values.

42. Gehrke, F.
1963. Forest soil surveys--methods, status, resulting information and use in management. In Forest Watershed Management Symposium. Oreg. State Univ., pp. 179-191.

43. Gessel, S. P.
1959. Forest soil fertility problems and research in the western United States. Soc. Amer. Foresters Proc. 1958: 177-180.

Fertilizers have potential value in increasing forest growth. Inventories of forest soils, basic tree nutrition studies, and field testing are needed to further the use of fertilizer in the forest industry.

44. ___________ and Abdullah, Shareeff.
1957. Response of 30-year-old Douglas-fir to fertilization. Soil Sci. Soc. Amer. Proc. 21: 236-239, illus.

Application of nitrogen fertilizer plus small amounts of phosphorus, potassium, and lime accelerated diameter and volume growth. Small trees were more rapidly suppressed. The 50 largest trees on the fertilized plot had about the same periodic annual increment as the total stand on the plot without fertilizer.

45. ___________ and Cole, D. W.
1958. Physical analysis of forest soils. First No. Amer. Forest Soils Conf. Proc. 1958: 42-48, illus.

Points out need for data on important soil physical properties and summarizes latest methodology.

46. ___________ and Walker, R. B.
1958. Diagnosing nutrient needs of forest trees. Better Crops with Plant Food 42(8): 26-31, 34-38, illus. (Also, in Forest Fertilization, pp. 20-27, 30-31, illus. 1958.)

Carefully standardized foliage analysis is useful in diagnosing nutrient needs of forest trees. Results of foliage analysis can be interpreted in terms of nutrient needs for maximum tree growth. Soil tests are more valuable if standard procedures are used and resulting data are related to foliage nutrient information.

47. ___________ and Walker, R. B.
1958. On growing forest trees. Plant Food Rev. 4: 17-20, 29.

Discusses the place of fertilizer in management of forest resources in the Pacific Northwest.

48. Gessel, Stanley P.
1948. Soil science and the forester. Univ. Wash. Forest Club Quart. 22(3): 3-12.

Describes the importance of forest soils information to forest managers and the need for increased research effort.

49. ___________
1949. Correlation between certain soil characteristics and site for Douglas-fir in northwestern Washington. Soil Sci. Soc. Amer. Proc. 14: 333-337, illus.

Productivity of land for Douglas-fir growth was predicted from soil characteristics. Texture and depth were especially influential. Within a single soil unit, site index was related to mean annual precipitation.

50. Gessel, Stanley P.
1962. Progress and problems in mineral nutrition of forest trees. In Tree Growth. Theodore T. Kozlowski, ed., pp. 221-235, illus. New York: The Ronald Press Co.

Summarizes, with special emphasis on Pacific Northwest research.

51. ____________ and Lloyd, William J.
1950. Effect of some physical soil properties on Douglas-fir site quality. Jour. Forestry 48: 405-410, illus.

Productivity of land for Douglas-fir growth was predicted from soil characteristics. Texture and depth were especially influential. Within a single soil unit, site index was related to mean annual precipitation.

52. ____________ Turnbull, Kenneth J., and Tremblay, F. Todd.
1960. How to fertilize trees and measure response. Natl. Plant Food Inst., 67 pp., illus.

Tells how to (1) fertilize soil to increase tree growth, (2) measure trees, and (3) evaluate growth rates after soil treatment.

53. ____________ and Walker, Richard B.
1956. Height growth response of Douglas fir to nitrogen fertilization. Soil Sci. Soc. Amer. Proc. 20: 97-100, illus.

Nitrogen fertilizer increased height growth of 15- to 20-year-old Douglas-fir on poor sites in western Washington. Large trees responded to fertilizer more than smaller ones. Foliage color was darker green when fertilizer was used. The latter finding is discussed as it relates to Christmas tree production.

54. ____________ Walker, Richard B., and Haddock, Philip G.
1950. Preliminary report on mineral deficiencies in Douglas-fir and western red cedar. Soil Sci. Soc. Amer. Proc. 15: 364-369, illus.

Douglas-fir and western redcedar require nitrogen, phosphorus, and potassium for good growth. Nitrogen is especially important. Western redcedar foliage contains more calcium than that of Douglas-fir.

55. Gilkeson, R. H., Starr, Warren A., and Steinbrenner, E. C.
1961. Soil survey of the Snoqualmie Falls Tree Farm. 10 pp., 14 maps. Weyerhaeuser Co. and Wash. Agr. Expt. Sta. cooperative publication.

Presents results of the first soil survey of an industrial tree farm in the Pacific Northwest.

56. Hale, Charles E.
1950. Some observations on soil freezing in forest and range lands of the Pacific Northwest. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 66, 17 pp., illus.

Under normal winter and early spring conditions, soil freezing occurs in all soil-cover complexes of eastern Oregon. Because of discontinuity and limited duration of impermeable frost, however, effect of frost on snowmelt runoff under average conditions appears unimportant in hydrologic considerations.

57. ___________
1951. Further observations on soil freezing in the Pacific Northwest. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 74, 8 pp., illus.

Under normal winter and early spring conditions, soil freezing occurs in all soil-cover complexes of eastern Oregon. Because of discontinuity and limited duration of impermeable frost, however, effect of frost on snowmelt runoff under average conditions appears unimportant in hydrologic considerations.

58. Hayes, G. L.
1952. Soil texture can influence forest regeneration from seed. U.S. Forest Serv. Tree Planters' Notes 11: 2.

Thirty-eight percent of Douglas-fir seed placed in a sandy loam soil produced seedlings compared with only 18 percent for those placed in pumice. Cutover tracts on fine-textured soils might thus have a better chance of regenerating naturally or from direct seeding than those on coarse pumice. Planting may be surer on pumice soils.

59. Heilman, Paul E., and Gessel, S. P.
1963. The effect of nitrogen fertilization on the concentration and weight of nitrogen, phosphorus, and potassium in Douglas-fir trees. Soil Sci. Soc. Amer. Proc. 27: 102-105, illus.

Almost twice as much nitrogen, greater quantities of potassium, and approximately equal amounts of phosphorus were contained in vegetation on fertilized plots as were contained in unfertilized vegetation. Douglas-fir needles increased in nitrogen more than branches and bark while wood did not increase.

60. ___________ and Gessel, S. P.
1963. Nitrogen requirements and the biological cycling of nitrogen in Douglas-fir stands in relationship to the effects of nitrogen fertilization. Plant & Soil 18: 386-402, illus.

Minimum nitrogen requirement for adequate growth of Douglas-fir is estimated at about 4,000 pounds per acre in soil and forest floor combined. Nitrogen fertilizer had a lasting effect on growth and nutrition of nitrogen-deficient Douglas-fir.

61. Hermann, Richard K.
1962. Root development and height increment of young ponderosa pine in pumice soils in central Oregon. (Abs.) Ecol. Soc. Amer. Bul. 43: 76.

Growth of 20- to 70-year-old ponderosa pine 12 to 15 feet tall was extremely slow until roots had penetrated the C horizon of nearly unweathered pumice. After roots reached the buried soil beneath pumice, however, height increment increased 50 to 150 percent. Tree growth was not related to chemical characteristics of the soil.

62. ________
1963. Temperatures beneath various seedbeds on a clearcut forest area in the Oregon Coast Range. Northwest Sci. 37: 93-103, illus.

Organic soil surfaces create a more severe microclimate above ground than do mineral surfaces. At a depth of 1 inch below organic surfaces, however, maximum temperatures averaged from 10° to 20° lower than those beneath mineral surfaces. Temperatures beneath mineral surfaces were not only higher than under organic surfaces but also persisted for a longer time.

63. Hill, W. W., Arnst, Albert, and Bond, R. M.
1948. Method of correlating soils with Douglas-fir site quality. Jour. Forestry 46: 835-841, illus.

Douglas-fir site quality appears to be related to soil moisture relationships. Within a given soil type, site index increases as precipitation increases.

64. Holtby, B. E.
1947. Soil texture as a site indicator in the ponderosa pine stands of southeastern Washington. Jour. Forestry 45: 824-825, illus.

Soil texture 6 inches below the surface was a fairly reliable indicator of site quality.

65. Isaac, Leo A., and Hopkins, Howard G.
1937. The forest soil of the Douglas fir region, and changes wrought upon it by logging and slash burning. Ecology 18: 264-279.

Authors conclude that damage to forest soil by slash burning is roughly proportional to the completeness with which fire consumes surface organic matter.

66. Lemmon, Paul E.
1955. Factors affecting productivity of some lands in the Willamette Basin of Oregon for Douglas-fir timber. Jour. Forestry 53: 323-330, illus.

Total effective soil depth was the most important factor in determining productive capacity of a site for Douglas-fir. This factor appears to gain its importance through internal water relationships of the soil profile.

67. ____________ Johnson, Roy A., and Krauter, Orlo W.
1955. Site index curves for lodgepole pine in the pumice area of central Oregon. Jour. Forestry 53: 553-555, illus.

Presents growth curve, site index table, and site index curves for lodgepole pine measured in natural, unmanaged stands on pumice soils in central Oregon. A method is suggested for adjusting U.S. and B.C. Forest Services' yield tables to use in central Oregon.

68. Lloyd, W. J., Schlots, F. E., and Deardorff, C. E.
1956. Forest management practices as related to and influenced by forest soil differences in western Washington. Soil Sci. Soc. Amer. Proc. 20: 105-107, illus.

Forest growth patterns are described for different soils. Specific forest management recommendations are given to illustrate fitting management to individual soils.

69. Lowry, G. L., and Youngberg, C. T.
1955. The effect of certain site and soil factors on the establishment of Douglas-fir on the Tillamook burn. Soil Sci. Soc. Amer. Proc. 19: 378-380, illus.

Aspect, slope steepness, and soil texture appeared to influence Douglas-fir seedling survival. Lowest seedling survival was on coarse-textured soils on slopes of more than 40 percent with a southerly aspect. Highest survival was on loam or silt loam where slope was less than 40 percent with a northerly aspect. Where mortality was high, soils had been depleted of available moisture for about 30 days.

70. Mader, Donald L.
1953. Physical and chemical characteristics of the major types of forest humus found in the United States and Canada. Soil Sci. Soc. Amer. Proc. 17: 155-158.

Presents data for humus layer samples from the Pacific Northwest, including a duff mull and a matted mor from Douglas-fir—western hemlock stands and a medium mull from beneath a Sitka spruce forest.

71. Mosher, Milton M.
1960. Irrigation and fertilization of ponderosa pine. Wash. Agr. Expt. Sta. Cir. 365, 5 pp.

Irrigation and fertilizer applications at the rate of 200 pounds ammonium nitrate (33.3 percent N) per acre in a 90-year-old stand of ponderosa pine in northeastern Washington produced these increases in diameter growth compared with controls:

Treatment	Percent increase
Once irrigated, nonfertilized	76
Twice irrigated, nonfertilized	139
Once irrigated, fertilized	127
Twice irrigated, fertilized	94
Nonirrigated, fertilized	29

72. McKeever, D. G.
1946. Forest site evaluation: its importance to the forest products industries. Soil Sci. Soc. Amer. Proc. 11: 511-513.

Discusses importance of soil as it affects tree growth and needs of the forest industry for better soil-site information.

73. McKell, Cyrus M., and Finnis, J. M.
1957. Control of soil moisture depletion through use of 2,4-D on a mustard nurse crop during Douglas-fir seedling establishment. Forest Sci. 3: 329-335, illus.

A nurse crop of mustard *(Brassica nigra)* can reduce high soil temperatures during Douglas-fir seedling establishment. Soil moisture depletion by the nurse crop can be reduced by spraying with 2,4-D during full bloom. Leaves, retained for some time after plant death, shade seedlings.

74. Plair, T. B.
1950. The work of the Forest-Soils Committee of the Douglas-fir Region. Jour. Forestry 48: 95-96.

Primary objectives of the Forest Soils Committee of the Douglas-fir Region (now the Northwest Forest Soils Council), formed in 1948, are to (1) promote thought and discussion of forest soils, (2) suggest problems for study by research workers, and (3) serve as a focal point for the collection and dissemination of forest soils information.

75. Powers, W. L.
1932. Characteristics of forest soils of the northwestern United States. Soil Sci. 34: 1-10.

Organic matter of Northwest forest soils is in many stages of decomposition and contains different amounts of mineral soil material. Maximum water vapor absorption and numbers of microbes were found in fermenting layers. Maximum base exchange capacity was in neutral fermenting layers containing approximately 75 percent organic matter. Feeding roots of trees were concentrated in the forest soil just below this layer.

76. __________ and Bollen, W. B.
1935. The chemical and biological nature of certain forest soils. Soil Sci. 40: 321-328.

The nutrient-supplying power of forest soils, especially for bases and nitrates, is centered in the F and H layers. Micro-organisms and macro-organisms are important in humus-nitrogen generation.

77. Sartz, R. S.
1953. Soil erosion on a fire-denuded forest area in the Douglas-fir region. Jour. Soil & Water Conserv. 8: 279-281, illus.

Raindrop splash, which left little visible evidence, caused erosion after wildfire. Thus, erosion on fire-denuded forest lands may be more common than generally believed.

78. Sartz, Richard S.
1951. The October floods in southwestern Oregon--some observations and speculations. Jour. Forestry 49: 189-191, illus.

Many logged areas showed no accelerated erosion after abnormally high rainfall, but most skidroads, dirt access roads, drainage ditches, and cut and fill slopes did erode. Suggested remedies for control of such erosion are well-planned roads with adequate drainage facilities, stabilization of cut and fill slopes by mulching or seeding, obliteration and herbaceous seeding of skidtrails, and restriction of travel on woods roads during periods of high rainfall.

79. Schlots, F. E., Lloyd, W. J., and Deardorff, C. E.
1956. Some soil characteristics which affect root penetration and timber site quality of Douglas fir in western Washington. Soil Sci. Soc. Amer. Proc. 20: 101-105.

Slope, aspect, position on slope, and landform are important environmental factors which influence forest regeneration, management, and logging practices. Site quality is influenced most strongly by a combination of soil properties used to determine soil type.

80. Starr, Warren A.
1956. Soils information for use of the managing forester. Soc. Amer. Foresters Proc. 1955: 85-89.

Discusses kinds of soil and topography information needed for forest management planning, methods of reporting such information, and how it can be used by the forester.

81. Starr, Warren A., and Tarrant, Robert F.
1955. Evaluating and mapping mountain land features for forest management purposes. Wash. Agr. Expt. Sta. Cir. 271, 22 pp., illus.

Reports a method of appraising and mapping geology, soil, and topographic conditions which bear on National Forest land management in the State of Washington.

82. Steinbrenner, E. C.
1955. The effect of repeated tractor trips on the physical properties of forest soils. Northwest Sci. 29: 155-159, illus.

Under dry soil conditions, four trips with an HD 20 tractor reduced macroscopic pore space by half and infiltration rate by over 80 percent. Effects from one tractor trip on moist soil equaled four trips when soil was dry.

83. ___________
1959. A portable air permeameter for forest soils. Soil Sci. Soc. Amer. Proc. 23: 478-481, illus.

The permeameter consists of a steel cylinder with carrying harness, constant pressure regulator, toggle-valve, soil tube, and pressure gauge. The tube is inserted into soil, a constant air pressure is delivered, and resistance of the soil to this pressure is read on the gauge as "percent macroscopic pore space." Application of this instrument to soil productivity studies is discussed.

84. ___________
1961. Ten years of forest soils research in retrospect and prospect. Weyerhaeuser Co. Bul., 18 pp.

A review of the past 10 years' work in forest soils research by the Weyerhaeuser Co. and a brief description of research proposed for the next 10 years.

85. ___________ Duffield, J. W., and Campbell, R. K.
1960. Increased cone production of young Douglas-fir following nitrogen and phosphorus fertilization. Jour. Forestry 58: 105-110, illus.

Greatest increase in tree growth and cone production was associated with nitrogen fertilizer treatments, although lesser increases occurred when phosphorus was applied together with a high rate of nitrogen.

86. __________ and Gessel, S. P.
1955. The effect of tractor logging on physical properties of some forest soils in southwestern Washington. Soil Sci. Soc. Amer. Proc. 19: 372-376.

Compared with an undisturbed timber area, soils affected by tractor logging had 35 percent less permeability, 2 percent greater bulk density, and 10 percent less macroscopic pore space. In tractor roads, permeability was reduced by 93 percent, bulk density was increased by 15 percent, and macroscopic pore space was reduced by 53 percent. Total area occupied by tractor roads was 26 percent of the cutting unit.

87. __________ and Gessel, S. P.
1956. Effect of tractor logging on soils and regeneration in the Douglas-fir region of southwestern Washington. Soc. Amer. Foresters Proc. 1955: 77-80, illus.

Tractor logging can seriously disturb soil through puddling, displacement, and compaction on skidroads. Soil compaction on skidroads, which cover 26 percent of the area logged by tractors, reduces stocking by nearly 50 percent and the number of established seedlings by two-thirds when compared with off-road conditions. Seedlings on roads were of poorer quality and showed less height growth the first 2 years than those planted off roads. In general, skidroads were poor growing sites for conifer seedlings.

88. __________ and Gessel, S. P.
1956. Windthrow along cutlines in relation to physiography on the McDonald Tree Farm. Weyerhaeuser Timber Co. Forestry Res. Notes, 19 pp., illus.

To lessen windthrow of Douglas-fir along cutlines, do not place cutting boundaries on the upper one-third of lee slopes, especially on or near saddles or ridges. Neither should cutlines be on shallow ridgetop soils or in poorly drained depressions. Avoid disturbing root systems, especially those of downhill buttressing roots, during salvage or roadbuilding operations.

89. Steinbrenner, Eugene C.
1953. Mustard seeding on burned forest areas. Weyerhaeuser Timber Co. Forestry Bul., 2 pp.

Mustard *(Bressica nigra)* was hand-seeded on a burned site to study its effect in controlling soil erosion. Natural forest vegetation which developed after the fire was as effective as seeded mustard in stabilizing soil and also prevented the mustard from reseeding the second year except where soil was disturbed.

90. Tarrant, R. F.
1947. First forest soil survey gives significant results. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 36, 4 pp.

In the Pringle Falls area of central Oregon, poorly drained soils generally support lodgepole pine but not ponderosa pine. Restricted air drainage, lower temperatures, more soil freezing, or frost damage in poorly drained soil areas may affect species distribution. The theory that competition after fire causes the present distribution pattern of the two species is questioned.

91. Tarrant, Robert F.
1947. A guide for forest soil examination in the Douglas-fir region. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta., 32 pp., illus. [Rev. 1950.]

Outlines some procedures used for examining and judging soil conditions.

92. ______
1948. The role of organic matter as a source of nitrogen in Douglas-fir forest soils. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 48, 4 pp., illus.

Regression analysis of total nitrogen and organic matter for 102 forest soil samples showed a close relationship between these two important soil properties. Most of the organic matter and nitrogen was in the uppermost soil layers.

93. ______
1949. Douglas-fir site quality and soil fertility. Jour. Forestry 47: 716-720.

No relation was found between Douglas-fir site class and pH, silt-plus-clay content, total nitrogen, available phosphorus and potassium, base exchange capacity, replaceable calcium and magnesium, or organic matter.

94. ______
1949. A program of forest soils research for the Pacific Northwest. Northwest Sci. 23: 64-71.

Outlines status of forest soils research in the Pacific Northwest as of 1948, and proposes a program of research. Proposals center about soil in relation to forest productivity, regeneration, and watershed management.

95. ______
1950. A preplanting forest soil survey. Jour. Forestry 48: 104-105.

A method of broadly evaluating productivity of land for planted Douglas-fir was based on a rating index which considered soil depth, texture, consistence, and organic matter content, plus slope and aspect.

96. ___________
1950. A relation between topography and Douglas-fir site quality. Jour. Forestry 48: 723-724.

On two different soil types, Douglas-fir site index was significantly higher for trees on concave rather than convex topography. Inclusion of a measure of topographic conditions is recommended for future forest soil surveys.

97. ___________
1953. Effect of heat on soil color and pH of two forest soils. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 90, 5 pp.

Soil color may roughly indicate intensity of a slash fire but cannot be used as a precise measure. Greatest change in soil pH results from burning temperatures below 900° F.

98. ___________
1953. Soil moisture and the distribution of lodgepole and ponderosa pine. (A review of the literature.) U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Paper 8, 10 pp.

A review of literature on lodgepole and ponderosa pine occurrence as influenced by soil moisture conditions. Consensus is that lodgepole pine occurs on more moist sites than does ponderosa pine.

99. ___________
1954. Effect of slash burning on soil pH. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 102, 5 pp.

Significant differences in soil pH were found between unburned and light burn, unburned and severe burn, and light and severe burn soil conditions. Soil reaction decreased significantly with an increase in time since burning. This decrease is related to severity of the burn. No significant pH differences were found between unburned soil in a clear cut and unburned-undisturbed soil in adjacent timber.

Intensity of burning is not uniform over a clear-cut area, nor is the entire area directly affected by the fire.

100. ___________
1954. Soil reaction and germination of Douglas-fir seed. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 105, 4 pp., illus.

Three independent tests indicated there was no relation between soil reaction to a maximum of pH 9.7 and germination of Douglas-fir seed.

Thus, high pH within limits found after slash burning apparently would not prevent germination of Douglas-fir seed.

101. Tarrant, Robert F.
1956. Changes in some physical soil properties after a prescribed burn in young ponderosa pine. Jour. Forestry 54: 439-441, illus.

Under conditions of soil, topography, weather, and fuels studied, prescribed burning did not harm and may have improved slightly the permeability and associated physical properties of the soil.

102. ________
1956. Effect of slash burning on some physical soil properties. Forest Sci. 2: 18-22, illus.

Severe burning greatly lowered rate of moisture movement in two soils. Light burning did not hamper movement of water within the surface 3 inches of soil, although macroscopic pore space was reduced. Severe burn occurred only in small, scattered patches that, combined, amounted to only a small portion of the total surface of slash-burned areas. Thus, overall influence of slash burning on soil moisture properties was minor.

103. ________
1956. Effects of slash burning on some soils of the Douglas-fir region. Soil Sci. Soc. Amer. Proc. 20: 408-411, illus.

Effects of slash burning vary with different soils. Although severe burning damages some soil properties, total soil area thus affected represents only a small portion of the total area logged and burned. In weighing effects of slash burning on soil, consideration must be given to relative amounts of lightly burned, severely burned, and unburned soil surface.

104. ________
1956. Forest soils of the Pacific Northwest. Soc. Amer. Foresters Proc. 1955: 73-76, illus.

Discusses soil characteristics of the Coast Ranges, glaciated areas, eastern and western slopes of the Cascade Range, Siskiyou Mountains, and Blue-Wallowa Mountains of the Pacific Northwest. Extreme complexity of climate and geology within these broad physiographic subregions creates a diverse pattern of forest soils.

105. ________
1957. Soil moisture conditions after chemically killing manzanita brush in central Oregon. U.S. Forest Serv. Pac. NW.

Forest & Range Expt. Sta. Res. Note 156, 4 pp., illus. (Also, in Tree Planters' Notes 33: 12-14, illus. 1958.)

Beneath green brush, percent moisture at the 12-inch depth declined more than twice that of nonvegetated plots. At the 24-inch depth, moisture decline under green brush was almost three times that of nonvegetated plots.

106. ———
1961. Stand development and soil fertility in a Douglas-fir--red alder plantation. Forest Sci. 7: 238-246, illus.

Admixture of red alder in a Douglas-fir plantation increased growth of dominant firs. Total nitrogen, both in soil and Douglas-fir foliage, was significantly greater in the alder-fir plantation than in adjacent pure fir.

107. ——— Isaac, Leo A., and Chandler, Robert F., Jr.
1951. Observations on litter fall and foliage nutrient content of some Pacific Northwest tree species. Jour. Forestry 49: 914-915.

Red alder foliage contained nearly three times the amount of nitrogen as the average of 11 other species. Foliage phosphorus content was relatively low for all species. The only two broad-leaved trees studied, bigleaf maple and red alder, contained high amounts of potassium compared with conifers. Western redcedar and bigleaf maple were the only species whose foliage contained more than 1 percent calcium.

108. ——— and Miller, Richard E.
1963. Accumulation of organic matter and soil nitrogen beneath a plantation of red alder and Douglas-fir. Soil Sci. Soc. Amer. Proc. 27: 231-234.

Beneath a plantation of red alder and Douglas-fir, soil nitrogen and organic matter were greater and bulk density and carbon-nitrogen ratio were less than in an adjacent pure fir plantation of the same age. An average of 36 pounds per acre more soil nitrogen has accumulated each year beneath the mixed stand than under pure fir.

109. ——— and Wright, E.
1955. Growth of Douglas-fir seedlings after slash burning. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 115, 3 pp., illus.

Growth of planted Douglas-fir seedlings was not inhibited by previous slash burning.

110. Trappe, James M.
1957. Some probable mycorrhizal associations in the Pacific Northwest. Northwest Sci. 31: 183-185.

The technique of tracing hyphae through the soil from sporocarps to mycorrhizae is uncertain when used alone. However, it may be combined with knowledge of the fungi known to form mycorrhizae and of the obligativity of some fungi to certain tree species to identify associations considered very probably mycorrhizal.

111. ___________
1960. Some probable mycorrhizal associations in the Pacific Northwest. II. Northwest Sci. 34: 113-117.

The technique of tracing hyphae through the soil from sporocarps to mycorrhizae is uncertain when used alone. However, it may be combined with knowledge of the fungi known to form mycorrhizae and of the obligativity of some fungi to certain tree species to identify associations considered very probably mycorrhizal.

112. ___________
1961. Some probable mycorrhizal associations in the Pacific Northwest. III. Northwest Sci. 35: 91-94.

The technique of tracing hyphae through the soil from sporocarps to mycorrhizae is uncertain when used alone. However, it may be combined with knowledge of the fungi known to form mycorrhizae and of the obligativity of some fungi to certain tree species to identify associations considered very probably mycorrhizal.

113. ___________
1962. Fungus associates of ectotrophic mycorrhizae. Bot. Rev. 28: 538-606.

A review of the limited literature comparing effects of different mycorrhizal fungi on their host; examines mycorrhizal associations from the standpoint of fungal taxonomic relationships; and presents new, updated lists of reported fungus-host associations.

114. ___________
1963. Some probable mycorrhizal associations in the Pacific Northwest. IV. Northwest Sci. 37: 39-43.

The technique of tracing hyphae through the soil from sporocarps to mycorrhizae is uncertain when used alone. However, it may be combined with knowledge of the fungi known to form mycorrhizae and of the obligativity of some fungi to certain tree species to identify associations considered very probably mycorrhizal.

115. ___________ and Harris, Robert W.
1958. Lodgepole pine in the Blue Mountains of northeastern Oregon. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Paper 30, 22 pp., illus.

A study aimed at understanding better the establishment, development, and characteristics of lodgepole pine stands in the Blue Mountains. Describes limitations of lodgepole pine to certain soils.

116. Vandecaveye, S. C., and Baker, G. O.
1938. Microbial activities in soil: III. Activity of specific groups of microbes in different soils. Soil Sci. 45: 315-333, illus.

A forest soil was compared with an agricultural soil to study relative rate of decomposition of different kinds of plant residues and their influence on microbial activity. Total number of microbes was about five times as great in the agricultural soil. Microflora differed greatly in kind between the two soils. Microbial activity in both soils was increased greatly by adding 1 percent wheat straw and sweetclover hay. Adding 1 percent pine needles and coniferous forest litter to agricultural soil also increased microbial activity.

117. Walker, R. B., Gessel, S. P., and Haddock, P. G.
1955. Greenhouse studies in mineral requirements of conifers: western red cedar. Forest Sci. 1: 51-60, illus.

Greenhouse study of western redcedar seedlings showed response to nitrogen and phosphorus fertilizer. Characteristic deficiency symptoms developed in plants deprived of essential nutrients.

118. Wheeting, L. C.
1940. The occurrence of Gray Forest soils in the Puget Sound region. West. Soc. Soil Sci., 6 pp.

Gray Forest soils in the Puget Sound region differ from those described in the literature by having shot pellets in the profile and lacking these attributes: clay accumulation in B horizons; marked structural features; evidence of former grassland status; and $CaCO_3$ in the solum or parent material.

119. Wheeting, Lawrence C.
1936. Shot soils of western Washington. Soil Sci. 41: 35-43.

The "shot clay" soils found in western Washington form only beneath forest vegetation under conditions of restricted drainage. Precipitation and dehydration of soluble iron and aluminum compounds around nuclei during the dry season are suggested as the method by which "shot" are formed.

120. ________
1938. Some forest-soil relationships. Northwest Sci. 12: 63-67.

Discusses influence of soil on tree growth.

121. Whittaker, R. H.
1954. The ecology of serpentine soils. IV. The vegetational response to serpentine soils. Ecology 35: 275-288, illus.

Vegetation on serpentine was compared with that on quartz diorite in the Siskiyou Mountains of southwestern Oregon. Vegetation patterns differed between the two soil materials in almost every respect that can be measured or described.

122. Winjum, Jack K., and Cummings, W. H.
1961. Effects of N, P, and K fertilizers on nursery-grown trees and shrubs common to Douglas-fir forests. Weyerhaeuser Co. Forestry Res. Notes 43, 11 pp., illus.

Growth of trees and shrubs was increased with fertilizer: (a) nitrogen--Douglas-fir, grand fir, Sitka spruce, western hemlock, bigleaf maple, bracken, Oregon grape, salmonberry, trailing blackberry, vine maple, and willow; (b) phosphorus--Douglas-fir, Sitka spruce, western hemlock, and vine maple.

123. Wollum, A. G., II.
1962. Grass seeding as a control for roadbank erosion. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 218, 5 pp., illus.

Grass seeded on a steep roadcut in western Oregon reduced erosion but caused increased runoff during a 3-year-observation period.

124. Wooldridge, David D.
1960. Watershed disturbance from tractor and Skyline Crane logging. Jour. Forestry 58: 369-372, illus.

Soil disturbance after logging with a Wyssen Skyline Crane was only one-fourth that caused by crawler-tractor logging. Skyline logging systems may be advantageous for harvesting timber in municipal watersheds and other areas previously closed to logging because of erosive soil conditions or steep, broken terrain.

125. Wright, Ernest.
1957. Importance of mycorrhizae to ponderosa pine seedlings. Forest Sci. 3: 275-280, illus.

Mycorrhizal fungi were destroyed by chlorpicrin and other poisonous gases used to fumigate soil in a ponderosa pine nursery. Lack of mycorrhizae led to stunted, chlorotic seedlings with significantly poorer survival after outplanting than plants having mycorrhizae.

126. ____________ and Bollen, W. B.
1961. Microflora of Douglas-fir forest soil. Ecology 42: 825-828, illus.

Number and kinds of soil micro-organisms varied with season of year, intensity of slash burning, and soil moisture content. Microbial studies should be standardized as to season, soil type, and sampling methods.

127. ___________ and Tarrant, Robert F.
1957. Microbiological soil properties after logging and slash burning. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 157, 5 pp.

Burning had greatest effect on microbiological activity in the uppermost surface soil. Intensity of burning was important in determining whether or not microbiological properties were altered. In most cases, unburned and lightly burned soils were not greatly different in number of organisms or ratio of bacteria to actinomycetes. In contrast, marked changes were noted in the microbiological population of severely burned soils.

128. ___________ and Tarrant, Robert F.
1958. Occurrence of mycorrhizae after logging and slash burning in the Douglas-fir forest type. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 160, 7 pp., illus.

Number of mycorrhizal Douglas-fir seedlings was related to whether the soil had been burned, but no real difference was found between intensities of burn. More 2-year-old seedlings had mycorrhizal roots than did 1-year-olds. Depth of first occurrence of mycorrhizae on seedling root systems was related to burn intensity on 1-year-old but not on 2-year-old trees. Abundance of mycorrhizae was not associated with intensity of burn nor was occurrence of mycorrhizae associated with soil pH.

129. Youngberg, C. T.
1953. Slash burning and soil organic matter maintenance. Jour. Forestry 51: 202-203.

Severity of the slash burn is reflected in depletion of soil organic matter. Elimination of fire hazard and preservation of soil organic matter should be ultimate aims in slash disposal operations.

130. ___________
1955. Effect of soils on the establishment of tree crops. Soil Sci. Soc. Amer. Proc. 19: 86-90.

Soil factors significant in establishment of planted stock and seedlings from natural or artificial seedfall are: texture and structure characteristics of the soil profile as they affect moisture and aeration; depth to ground water; content of soil organic matter; and chemical properties, including soil fertility and occurrence of layers high in soluble salts and toxic substances.

131. Youngberg, C. T.
1955. Some site factors affecting the success of reforestation and afforestation activities in the Willamette Valley foothills. Soil Sci. Soc. Amer. Proc. 19: 368-372, illus.

The narrow range of readily available moisture in many soils of the Willamette Valley is responsible for difficulties encountered in reforestation and afforestation.

132. ———
1957. A modification of the hydrometer method of mechanical analysis for certain western forest soils. Soil Sci. Soc. Amer. Proc. 21: 655-656.

Difficulty in completely dispersing samples for mechanical analysis has been experienced with many western forest soils. In this study, four different methods of dispersing the samples were investigated. For latosolic soils, shaking with sodium hydroxide gave better dispersion than without. With Western Brown Forest soils there was no difference with or without sodium hydroxide.

133. ———
1958. The uptake of nutrients by western conifers in forest nurseries. Jour. Forestry 56: 337-340.

For most species, nutrient removal from the soil was highest for nitrogen, intermediate for potassium, and lowest for phosphorus and calcium. Uptake and content of nitrogen and calcium was lower than for eastern coniferous species and similar for phosphorus and potassium.

134. ———
1959. The influence of soil conditions, following tractor logging, on the growth of planted Douglas-fir seedlings. Soil Sci. Soc. Amer. Proc. 23: 76-78.

Results of soil analysis, particularly in regard to aeration, moisture relationships, and nitrogen content, indicated that tractor roads offer a poor medium for growth of Douglas-fir seedlings.

135. ———
1959. The influence of soil moisture on survival of planted Douglas-fir seedlings on clay soils. Jour. Forestry 57: 842-844, illus.

A rapid increase in rate of planted Douglas-fir seedling mortality is related to soil moisture depletion below "readily available" levels. Influence of site preparation on moisture depletion is discussed.

136. ____________
1963. Forest soils--their characteristics in the Pacific Northwest. *In* Forest Watershed Management Symposium. Oreg. State Univ., pp. 21-32, illus.

Describes major forest soil zones, great soil groups, and humus types found in Oregon and Washington. Influence of topography and parent material is discussed in relation to soil development.

137. ____________ and Austin, R. C.
1954. Fertility standards for raising Douglas-fir in forest nurseries. Jour. Forestry 52: 4-6.

Levels of nursery soil fertility necessary for raising good Douglas-fir seedlings are suggested from results of sampling and analyzing surface soils from representative areas in the Douglas-fir region.

138. ____________ and Dyrness, C. T.
1959. The influence of soils and topography on the occurrence of lodgepole pine in central Oregon. Northwest Sci. 33: 111-120, illus.

Describes influence of soil drainage and topographic position in relation to cold air drainage on distribution of lodgepole pine as a climax species on pumice soils of central Oregon.

139. Youngberg, Chester T., and Steinbrenner, Eugene C.
1953. Nursery soil research at the Forest Industries Nursery, Nisqually, Washington. Weyerhaeuser Timber Co. Res. Notes, 21 pp.

Aim of research was to produce better balanced nursery stock by use of fertilizers, soil conditioners, and organic matter additions.

INDEX

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